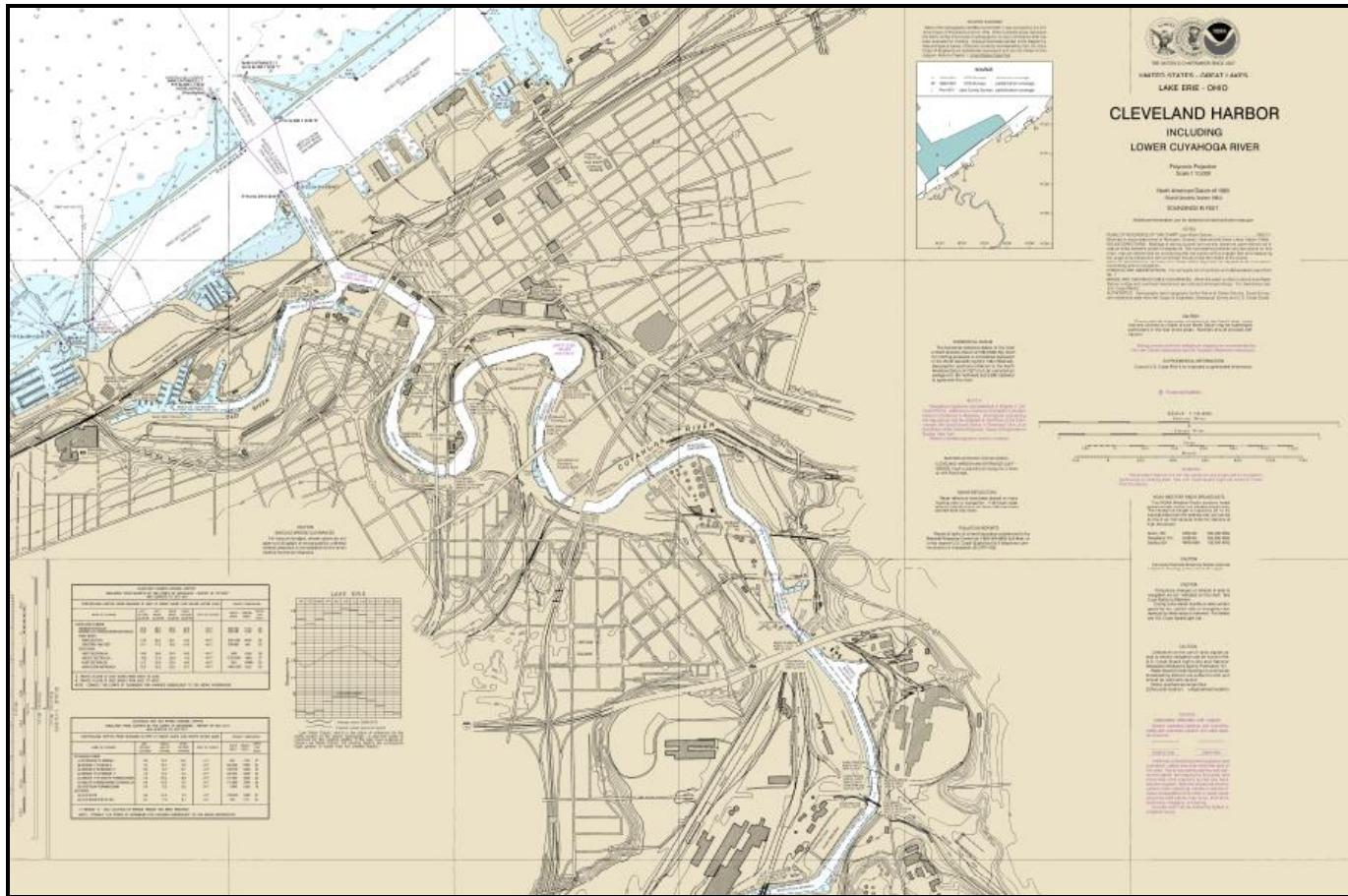


Ports and Waterways Safety Assessment

Workshop Report

Cuyahoga River, Ohio



United States Coast Guard
Marine Transportation Systems Directorate



Providing Navigation Safety Information
for America's Waterways Users

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Background and Purpose

The United States Coast Guard (USCG), Marine Transportation Systems Directorate, is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and inspire dialogue with ports and waterway users with the goal of making waterways as safe, efficient, and commercially viable as possible.

Through the 1997 Coast Guard Appropriations Act, the Coast Guard was directed to establish a process to identify minimum user requirements for new Vessel Traffic Service (VTS) systems in consultation with local officials, waterway users and port authorities, and to review private / public partnership opportunities in VTS operations. The Coast Guard convened a National Dialogue Group (NDG) comprised of maritime and waterway community stakeholders to identify the needs of waterway users with respect to Vessel Traffic Management (VTM) and VTS systems. The NDG was intended to provide the foundation for the development of an approach to VTM that would meet the shared government, industry, and public objective of ensuring the safety of vessel traffic in U.S. ports and waterways, in a technologically sound and cost effective way.

From the NDG came the development of the ***Ports and Waterways Safety Assessment (PAWSA) Waterway Risk Model***, and the ***PAWSA workshop process***. PAWSA is a disciplined approach designed to identify major waterway safety hazards, estimate risk levels, evaluate potential mitigation measures, and set the stage for the implementation of selected risk reduction strategies. The process involves convening a select group of waterway users and stakeholders and facilitating a structured workshop agenda to meet the risk assessment objectives. A successful workshop requires the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. In addition, stakeholders are included in the process to ensure that important environmental, public safety, and economic consequences are given appropriate attention as risk interventions are identified and evaluated.

The long-term goals of the PAWSA process are to:

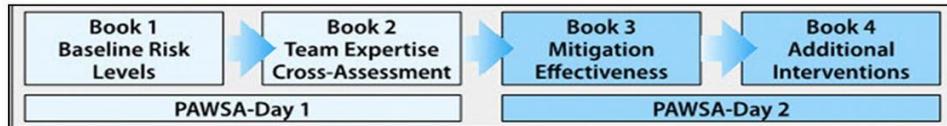
- 1) Provide input when planning for projects to improve the safety of navigation,
- 2) Further the Marine Transportation System (MTS) goals of improved coordination and cooperation between government and the private sector, and involving stakeholders in decisions affecting them,
- 3) Foster development and/or strengthen the roles of Harbor Safety Committees within each port, and
- 4) Support and reinforce the role of Coast Guard Sector Commanders/Captains of the Port (COTP) in promoting waterway and VTM activities within their geographic areas of responsibility.

60 ports/waterways have been assessed or reassessed using the PAWSA process. The risk assessment process represents a significant part of joint public-private sector planning for mitigating risk in waterways. When applied consistently and uniformly in a number of waterways, the process is expected to provide a basis for making best value decisions for risk mitigation investments, both on the local and national level. The goal is to find solutions that are cost effective and meet the needs of waterway users and stakeholders.

PAWSA Waterway Risk Model and Workshop process

The PAWSA Waterway Risk Model includes variables dealing with both the causes of waterway casualties and their consequences. In the Waterway Risk Model, risk is defined as a function of the probability of a casualty and its consequences. The diagram below shows the six general risk categories, and corresponding risk factors, that make up the Waterway Risk Model.

Waterway Risk Model					
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic



- **Vessel Conditions** – The quality of vessels and their crews that operate on a waterway.
- **Traffic Conditions** – The number of vessels that use a waterway and how they interact with each other.
- **Navigational Conditions** – The environmental conditions that vessels must deal with in a waterway.
- **Waterway Conditions** – The physical properties of the waterway that affects vessel maneuverability.
- **Immediate Consequences** – The instantaneous impacts to the port as a result of a vessel casualty.
- **Subsequent Consequences** – The longer-term impacts felt days, months, and even years afterwards.

Workshop activities include a series of discussions about the port/waterway attributes and the vessels that use the waterway, followed by completion of workbooks to establish baseline risk levels, evaluate the effectiveness of existing risk mitigations, and identify additional risk intervention strategies to further reduce risk in the port / waterway. Workbook 1 is used to numerically evaluate the baseline risk levels using pre-defined qualitative risk descriptions for pre-defined risk factors. Workbook 2 is used to assess the expertise of participants with respect to the risk categories in the model. Those expertise assessments are used to weight inputs obtained during the other steps in the workshop process. Workbook 3 is used to evaluate how effective the existing mitigation strategies are at reducing risks, and to determine if the risks are well balanced or not. For those risk factors where risk is judged to be not well balanced by existing mitigations, participants use workbook 4 to identify additional risk intervention strategies and then evaluate how effective those new strategies could be at reducing risks.

Cuyahoga River PAWSA Workshop

A PAWSA workshop to assess navigation safety on the Cuyahoga River was held in Cleveland, Ohio on 1-2 August, 2018. The workshop was attended by 30 participants representing waterway users, stakeholders, environmental interest groups, and Federal, State and local regulatory authorities. The sponsor of the workshop was Coast Guard Marine Safety Unit Cleveland.

The purpose of the workshop was to bring waterway users, stakeholders and members of the Cuyahoga River maritime community together for collaborative discussions. Participants discussed the quality of vessels and their crews that operate on the waterway; the volume of commercial, non-commercial and recreational small craft vessel traffic using the waterway, navigational and waterway conditions that mariners encounter when transiting the assessment area, and the potential environmental impacts that could result from a marine casualty or incident on the waterway.

Over the two-day workshop, the participants discussed and then numerically evaluated each of the 24 risk factors in the PAWSA model. Baseline risk levels were first evaluated using pre-defined qualitative risk descriptions for each risk factor. Participants then discussed existing risk mitigation strategies, evaluated how effective those mitigation strategies were at reducing risk, and then determined if the risks were balanced.

For the following 12 risk factors, there was consensus (defined as 2/3 of the workshop participant teams agreeing) that risks were balanced by existing mitigations.

Risk Factor	Risk Level with Existing Mitigations
Visibility Restrictions	5.1
Volume of Commercial Traffic	4.1
Petroleum Discharge	3.6
Hazardous Materials Release	3.1
Water Movement	3.1
Winds	2.2
Shallow Draft Vessel Quality	1.8
Deep Draft Vessel Quality	1.7
Commercial Fishing Vessel Quality	1.6
Aquatic Resources	1.2
Health and Safety	1.0
Environmental	1.0

For the following 3 risk factors, there was no consensus that risks were balanced, or not balanced, by existing mitigations.

Risk Factor	Risk Level with Existing Mitigations
Configuration	8.4
Economic	7.9
Visibility Impediments	6.6

For the remaining 9 risk factors, *there was consensus that risks were NOT balanced* by existing mitigations. For these risk factors, the participants engaged in further discussions to identify additional risk mitigation strategies, and then evaluated how effective those new strategies could be at reducing risk. Due to workshop time constraints, the participants discussed and selected the Small Craft Quality, Traffic Mix and Congestion risk factors for the workbook 4 evaluations.

The following shows the results of the workbook 4 evaluations:

Risk Factor	Risk Level with Existing Mitigations	Risk Level with Proposed Mitigations
Small Craft Quality	8.3	7.0
Traffic Mix	8.3	7.0
Congestion	8.1	6.3
Mobility	8.5	Not Evaluated
Personnel Injuries	8.2	Not Evaluated
Dimensions	7.4	Not Evaluated
Obstructions	7.3	Not Evaluated
Volume of Small Craft Traffic	6.2	Not Evaluated
Bottom Type	5.1	Not Evaluated

The results of the workbook 4 evaluations showed the most chosen general risk mitigation strategy to further reduce risk for the Small Craft Quality and Congestion risk factors was *to more actively enforce existing rules, regulations and policies.*

The most chosen general risk mitigation strategy to further reduce risk for the Traffic Mix risk factor was *to employ voluntary training programs* (Coast Guard Auxiliary, U.S. Power Squadrons, and State and Local boating safety outreach programs) to educate waterway users on topics related to waterway and navigation safety.

The results of the baseline risk levels, existing risk mitigations, additional risk intervention strategies, and a representative summary of participant comments and observations are outlined in this report. A nautical chart was displayed of the assessment area for reference and to annotate geographic locations associated with participant comments and observations; excerpts from the annotated chart are included as an appendix to this report.

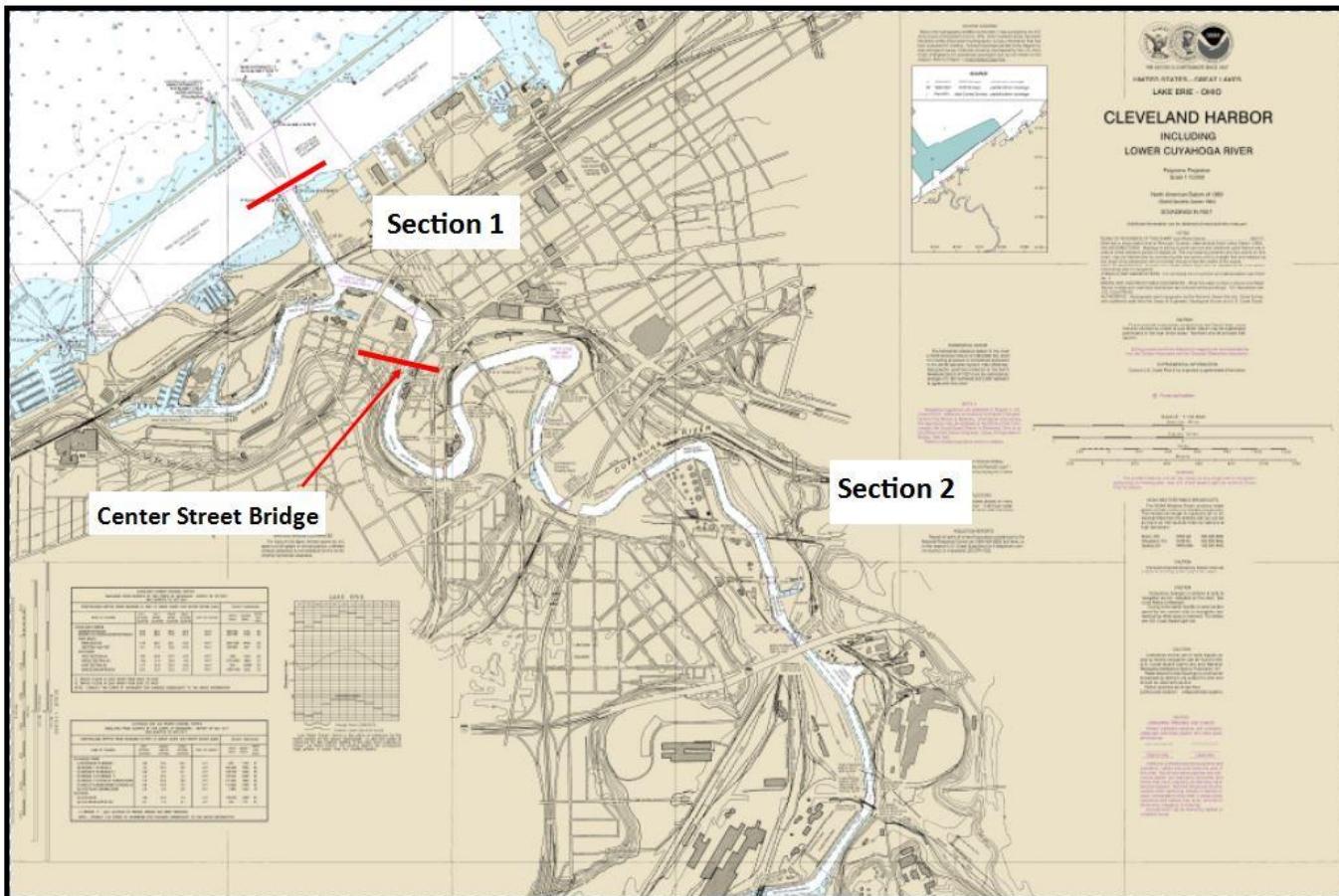
The primary goal of a PAWSA workshop is to improve coordination and cooperation between government and the private sector. A PAWSA workshop is intended to involve stakeholders in decisions affecting them, and provide the Coast Guard and members of the waterway community with an effective tool to evaluate risk and work toward long-term solutions tailored to local circumstances. In support of these goals, this report should be viewed as a starting point for continued dialogue within the Cuyahoga River maritime community.

The Coast Guard and Marine Safety Unit (MSU) Cleveland would like to thank all who participated in the PAWSA Workshop for Cleveland, Ohio. This PAWSA report highlights areas with heightened safety concerns and provides potential solutions to reduce risk. Although these risk-mitigating options are not requirements, they provide a functional starting point as we continue to discuss safety improvements on the Cuyahoga River. MSU Cleveland looks forward to working closely with all stakeholders and waterway users as we strive to promote the safe use of Cleveland's waterways.

Section 1: Cuyahoga River PAWSA - Assessment Area

The geographic bounds of the waterway assessment area included the Cuyahoga River, from the break wall entrance to the head of navigation, and the Old River. The nautical chart referenced and displayed was 14839.

At the beginning of the workshop, the participants briefly discussed the assessment area and collectively chose to break the assessment area into 2 separate sections, with the Center Street Bridge being the dividing location. The volumes of small craft traffic, degree of traffic mix, and levels of congestion were much higher in section 1, than in section 2 of the assessment area. Dividing the assessment area into 2 sections allowed the participants to discuss the differences in traffic types and congestion present within the separate sections.



Section 2: Baseline Risk Levels

The first step in the workshop was the completion of workbook 1 to determine a baseline risk level value for each risk factor in the Waterway Risk Model. To establish the baseline risk levels, participants discussed each of the 24 applicable factors in the Waterway Risk Model and selected a qualitative description for each risk factor that best described the conditions in the assessment area. These qualitative descriptions were converted to discrete values using numerical scales that were developed during earlier PAWSA workshops. The end result is the risk level for each risk factor, not taking into account any actions already implemented to reduce risk.

On those scales, 1.0 represents low risk (best case) and 9.0 represents high risk (worst case), with 5.0 being the mid-risk value. Risk values highlighted in red (values at or above 7.7) denote very high baseline risk levels; risk values highlighted in green (values at or below 2.3) denote very low baseline risk levels.

The table below shows the baseline risk level values for all risk factors as determined by the workshop participants.

Baseline Risk Levels					
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
1.9	4.1	2.3	6.8	9.0	1.0
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
2.1	5.8	3.4	7.3	3.8	1.0
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
1.7	8.4	5.2	4.7	3.1	1.0
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
8.8	8.1	6.9	9.0	9.0	8.2

Section 3: Team Expertise Cross-assessment

The second step in the workshop was the completion of a team expertise cross-assessment (workbook 2). The team expertise cross-assessment was conducted early in the workshop process and was used to weigh the relative strengths of each team with respect to the six risk categories. The results of the team expertise cross-assessment was used to weight the inputs that each team provided in the other workbooks completed during the workshop.

After being presented with the concepts underlying the model, each participant team was asked to discuss (among themselves) how their background and experience aligns with the model. They then verbally presented their self-assessment to the other teams. These presentations gave all teams a sense of where everyone thought they were strong – or perhaps not so strong. After all teams had spoken, each team then evaluated whether they were in the top, middle, or lower third of all teams present with respect to knowledge and expertise in the six risk category areas. The participants assessed their own and all the other participant teams' level of expertise for each of the six categories in the Waterway Risk Model.

The table below breaks down the participants' expertise for each risk category, and indicates a very high level of expertise for the Traffic Conditions Risk Category.

Team Expertise -- Distribution

Risk Category	Top 1/3	Mid 1/3	Lower 1/3
Vessel Conditions	38%	39%	23%
Traffic Conditions	72%	16%	12%
Navigational Conditions	42%	35%	23%
Waterway Conditions	36%	40%	24%
Immediate Consequences	12%	61%	27%
Subsequent Consequences	25%	22%	53%
All Categories Average	38%	36%	27%

The table above breaks down the participants' expertise distribution for each risk category. The “ideal” split is an even distribution (33%) between the three expertise levels.

Percentages highlighted in yellow indicate a value that is either 50% higher or 50% lower from the ideal (33%) distribution mix. Values at or above 50%, and values at or below 16%, fall into this category.

Percentages highlighted in red indicates a value that is 100% higher from the ideal (33%) distribution mix. Values at or above 66% fall into this category.

Section 4: Existing Risk Mitigations

The third step in the workshop was for participants to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each risk factor. Workbook 3 is used for two purposes. First, after the participants describe the risk mitigation strategies that already exist to help reduce the risk level for their waterway, workbook 3 is used to evaluate the effectiveness of those strategies in reducing the risk level for each factor in the model. What results from that evaluation is the present risk level, taking into account those existing mitigations. Second, the participants decide whether the risk mitigation strategies already in place adequately balance the resulting risk level. If, for any given risk factor, there is consensus (defined as 2/3 of the workshop participant teams in agreement) that existing mitigations do adequately deal with those risks, then that risk factor is dropped from further discussion.

For risk factors shown in green (Balanced) there was consensus that risks were balanced by existing mitigations.

For risk factors shown in red (Rising/No) there was consensus that risks were not balanced by existing mitigations.

For risk factors shown in yellow (Maybe) there was no consensus that risks were balanced by existing mitigations.

Mitigation Effectiveness							
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences		
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety		
1.9 1.7	4.1 4.1	2.3 2.2	6.8 6.6	9.0 8.2	1.0 1.0		
Balanced	Balanced	Balanced	Maybe	NO	Balanced		
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental		
2.1 1.8	5.8 6.2	3.4 3.1	7.3 7.4	3.8 3.6	1.0 1.0		
Balanced	Rising	Balanced	Rising	Balanced	Balanced		
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources		
1.7 1.6	8.4 8.3	5.2 5.1	4.7 5.1	3.1 3.1	1.0 1.2		
Balanced	NO	Balanced	Rising	Balanced	Balanced		
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic		
8.8 8.3	8.1 8.1	6.9 7.3	9.0 8.4	9.0 8.5	8.2 7.9		
NO	NO	Rising	Maybe	NO	Maybe		

Risk Factor	
Book 1 Score	Book 3 Score
Concensus Reached?	

EXPLANATION	
Book 1 Score	Level of risk - not taking into account existing mitigations
Book 3 Score	Level of risk - taking into account existing mitigation
Balanced	Consensus that risks are well balanced by existing mitigations
Maybe	No consensus that risks are well balanced by existing mitigations
Rising / NO	Consensus that existing mitigations DO NOT adequately balance risks

Section 5: Additional Risk Intervention Strategies

The last step in the workshop process was to complete workbook 4, wherein workshop participants propose additional risk interventions. Participants suggest additional risk intervention strategies, and then evaluated how successful the proposed strategies could be at lowering risk levels.

Additional mitigations were discussed for those risk factors where there was consensus that risks were not adequately balanced by existing mitigation (Rising/No) from the workbook 3 evaluation. Due to workshop time limitations only the Small Craft Quality, Traffic Mix and Congestion risk factors were included in the workbook 4 evaluation/discussion process.

The table below shows the expected level of risk if taking the actions recommended by the participants.

Additional Interventions					
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Balanced	Balanced	Balanced	Book 4 not completed	Book 4 not completed	Balanced
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Balanced	Book 4 not completed	Balanced	Book 4 not completed	Balanced	Balanced
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Balanced	Voluntary Training	Balanced	Book 4 not completed	Balanced	Balanced
	7.0				
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
Enforcement	Enforcement	Book 4 not completed	Book 4 not completed	Book 4 not completed	Book 4 not completed
7.0	6.3				

EXPLANATION		
Risk Factor	Intervention Category	Intervention category that most participants selected to further reduce risks
Intervention Category	Risk Improvement	The expected level of risk that would be obtained if new mitigations measures were implemented
Risk Improvement	CAUTION - NO CENSUS ALERT	When Caution is displayed, an intervention strategy other than the one displayed was judged to provide more risk reduction than the one displayed. This is an indicator that the teams were divided in their opinions about what actions should be taken to further reduce risks for that factor. It indicates there is possibility more than "one" best mitigation measure to achieve further risk reduction.

Voluntary Training: Employ voluntary training programs (Coast Guard Auxiliary, U.S. Power Squadrons, and State and Local boating safety outreach programs) to educate waterway users on topics related to waterway and navigation safety.

Enforcement: More actively enforce existing rules, regulations and policies.

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Appendix A

Cuyahoga River PAWSA - Workshop Participants

Glen Nekvasil	Lake Carriers Association
Paul Joquin	Grand River Navigation
Paul Christensen	Interlake Steamship Company
Mike Stewart	American Steamship Company
Criquet Codeluppi	Cleveland Marine Towing
Lindsay Dew	Great Lakes Towing
Jordan Kit	Passenger Vessel Goodtime III
Michael Bobincheck	Cleveland Metro Parks – ELCEE 2
Joseph Slusarski	Passenger Vessel Nautica Queen
Rob Clarke	Flats East Bank
Melinda Gigante	Flats Forward
Paul Ertel	Nautica Complex/Shooters
Christopher DiGiovanni	U.S. Coast Guard Station Cleveland Harbor
Blaine Downing	Ohio Department of Natural Resources
Robert Simon	Cleveland Police Department
Seth Willits	Cleveland Metro Parks Rangers
Dion Kiernan	Old River Yacht Club
Sam Insalaco	U.S. Power Boat Squadrons
Casey Talbott	Norfolk Southern Railroad Bridge
Lee Soule	U.S. Coast Guard District 9 - Bridges
Ryan Junod	U.S. Coast Guard MSU Cleveland
Josh Feldmann	U.S. Army Corps of Engineers
Jared Magyar	Cleveland Port Authority
Bill Cochrane	Nalu Standup Paddle and Surf
Ashely Rossetti	Cleveland Metro Parks
Kirk Lang	Cleveland Rowing Foundation
Drew Ferguson	PHASTAR
Ken Alvey	Lake Erie Marine Trades Association
Bryan Ralston	Lake Erie Marine Trades Association

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Appendix B

The workshop participants are local subject matter experts and these comments capture their opinions and analysis, providing a general sense of the ideas discussed during the workshop. These comments provide various perspectives representing widely different interests and should not be construed to represent the views of or statements by the United States Coast Guard.

Participant Comments on Trends in the Port and Existing Risk Mitigations

Deep Draft Vessel Quality:

Trends/Observations:

- Vessels in this category are 1600 gross tons or greater.
- Vessels that operate within the assessment area are U.S. and Canadian flagged ships and the crews all speak English. Although the vessels are old by age, they operate in freshwater and are in pristine condition compared to foreign-flagged saltwater vessels entering from sea and operating on the Great Lakes. U.S. and Canadian flagged deep draft commercial vessels present a very low risk because of well-established maintenance programs, Coast Guard inspection requirements, third party inspections, classification oversight, and U.S and Canadian crew nationalities (no language barriers).
- Crew proficiency is also very high. Captains and crews have been operating the same vessels for many years within the assessment area, have expert knowledge on how their vessels maneuver and handle within the confined river system, and are very familiar with the challenges of navigating large vessels within the confined waters of the Cuyahoga River.

Existing Mitigations:

- U.S. Coast Guard vessel inspection regulations.
- Licensing and training requirements for operators including required refresher training.
- Vessel crews are required to carry out emergency drills annually as part of the Coast Guard vessel inspection requirements.
- The majority of vessels in this category also are classified by the American Bureau of Shipping.
- Vessels have developed checklist to test equipment (steering systems, Automatic Identification Systems (AIS), radios, etc.). Equipment tests are conducted prior entering the Cuyahoga River, and when getting underway after cargo operations are complete.

Shallow Draft Vessel Quality:

Trends/Observations:

- Vessels in this category are less than 1600 gross tons.
- Towing vessels that assist deep draft vessels navigating within the assessment area are in very good condition. Like the deep draft vessels, all crewmembers are either of U.S. or Canadian nationality, have expert knowledge on how their vessels maneuver, and are very experienced at operating on the Cuyahoga River system.
- The three large passenger-carrying vessels that operate within the assessment area are in also very good condition. They operate on relatively short routes and for limited time periods (1-3 hour cruises). These vessels are not routinely exposed to rough weather conditions; only the largest of the three passenger vessels in this category departs the Cuyahoga River.
- Crewmember proficiency is very high on both towing vessels and passenger vessels. Crews are very familiar with the Cuyahoga River system and have extensive experience operating their vessels in very close proximity to the numerous small craft that also use the waterway.

Existing Mitigations:

- U.S. Coast Guard vessel inspection regulations.
- Licensing and training requirements for operators including required refresher training.
- Vessel crews are required to carry out emergency drills annually as part of the Coast Guard vessel inspection requirements

Commercial Fishing Vessel Quality:

Trends/Observations:

- There are no commercial fishing vessels that operate within the assessment area. Some subsistence fishing does occur outside the assessment area, with the fishing vessels only transiting the river to reach the offshore fishing grounds.

Small Craft Quality:

Trends/Observations:

- Vessels included in this category include power driven vessels, sailing vessels, Jet Skis, paddle boarders, rowers and kayakers.

- The lack of maritime experience and knowledge of the navigation regulations on the part of some recreational boaters increases the risk of a collision, allision or grounding.
- Paddle boarders and kayakers pose higher risks than motorized small craft and rowers who have some formalized training. Jet Ski rentals are also a safety concern because operators generally have little or no experience operating within the assessment area, and exhibit over confidence that they can get maneuver close to, and then out of the way of deep draft commercial vessels.
- The small craft community is generally unaware of the dangers of that deep draft propeller wash, and vessel bow and stern thrusters, pose to them. Inexperienced paddle boarders and kayakers can also negatively affect the efficiency of deep draft vessel transits. When a deep draft vessel has to slow or stop its transit due to paddle boarders and/or kayakers blocking the channel, it takes time and energy to stop/slow the vessel, and then get the vessel moving again once the channel is clear.

Existing Mitigations:

- City, County, State, and Federal stakeholders, as well as a diverse array waterway users, have implemented safety awareness programs to increase awareness and adherence to maritime safety rules and the City of Cleveland ordinances.
- The Cuyahoga River Safety Task Force actively promotes waterway safety on the river and recently produced a boater education video to inform small craft operators about the dangers of operating in close proximity to the larger commercial vessels. Progress has been made to educate the small craft community on navigation safety and the importance of staying clear of deep draft vessels when they transiting the river system, but more needs to be done to ensure a safe, enjoyable, and functional Cuyahoga River.
- The Coast Guard and Cleveland Metro Parks have engaged paddleboard and kayak rental companies to ensure persons renting these type of small craft are informed about the dangers of operating on the a busy, confined, mixed-use waterway; and specifically, the risks when operating paddleboard and kayak craft in close proximity to deep draft vessels.
- Ohio Department of Natural resources (ODNR) regulations for power boaters based on vessel size and horsepower. A mandatory boating education class is required to operate a power driver boat with over 10 horsepower.
- Vessel safety checks, dockside exams and safety classes provided by the Coast Guard Auxiliary and U.S. Power Squadrons for small craft operators.

Volume of Commercial Traffic:

Trends/Observations:

- There are approximately 2,300 commercial vessel movements each year for the Port of Cleveland and associated waterways. Some of these vessel movements occur in Cleveland's Inner Harbor only, and do not enter the Cuyahoga and Old Rivers. However, the vast majority of the transits by U.S and Canadian commercial vessels occur within the Cuyahoga River system.
- There are approximate four transits per day (two up bound and two down bound) for deep draft commercial vessels transporting ore to the to ArcelorMittal steel mill located at the head of navigation on the Cuyahoga River. The steel mill receives approximately 300 ore deliveries during the typical shipping season (March to January). Currently, there are five vessels that deliver ore to the strel mill.
- There are three Coast Guard certificated and inspected passenger vessels that operate within the assessment area. There are approximately 1000 passenger vessel transits per season.
- Water taxi service operates between the East Bank and West Bank, with Fridays and Saturdays being the busiest operating days.
- The passenger vessel-operating season is relatively short for the majority of the passenger vessels, and runs from Easter to Labor Day.
- There are approximately 10 commercial vessel transits per day during the week, and approximately 20 commercial vessel transits per day on Saturdays and Sundays.
- Dredging is seasonally and last for approximately 6 weeks. During the dredging season, a single barge makes a transit of the river system approximately every three or four hours.

Existing Mitigations:

- Security calls to alert other mariners of the transit and maneuvering intentions of commercial vessel traffic.
- AIS to broadcast courses and speeds of commercial vessels.

Volume of Small Craft Traffic:

Trends/Observations:

- The small craft community operating on the Cuyahoga River is very diverse and includes Jet Skis, kayaks, paddleboards, powerboats, sailing vessels, water taxies, and pontoon boats. The volume is very high, but on a seasonal basis.
- The typical small craft boating season runs from approximately June to Labor Day. Some recreational vessels operate after Labor Day, but the volume is very low.

- The increasing popularity of and easy access to paddle craft rentals has resulted in growing paddle craft use in the assessment area.
- The volume of small craft traffic is much higher in the assessment area section 1 than in section 2. The recent development of the Cuyahoga Flats East waterfront has resulted in a big increase in the volume of small craft traffic operating in section 1.
- The rowing community primarily operates in section 2 of the assessment area.

Existing Mitigations:

- Marine events that attract large numbers of recreational small craft are permitted by the U.S. Coast Guard.
- Security calls to alert other mariners of the transit and maneuvering intentions of commercial vessel traffic.
- Law Enforcement patrols conducted during the busy weekend periods.

Traffic Mix:

Trends/Observations:

- The assessment area experiences a very heavy mix of recreational and commercial vessel traffic. There are very close interactions between large commercial vessels and recreational vessels due to the limited width of the Cuyahoga River.
- The Old River is a high-risk area when deep draft vessels are transiting the area.
- At times, there is over-communication on VHF radios. Many recreational boaters do not actively monitor VHF radio transmissions, and increase radio chatter by constantly asking when the Norfolk Southern Railroad Bridge #1 (NS-1) is going to go up, despite a radio broadcast that just announced the time when the bridge was going to go up.
- Close quarters meeting/passing interactions between the rorer and deep draft commercial traffic occurs in the upper parts of the river above Marathon Bend, West 3rd Street, and Collision Bend.

Existing Mitigations:

- The interactions between commercial vessels operators is very good; the same mariners communicate with each other on a daily basis. Commercial vessel operators are aware of the challenges of navigating larger deep draft vessels within the river system and take precautions to alleviate close quarters interactions.
- Security calls to alert other mariners of the transit and maneuvering intentions of commercial vessel traffic.
- Cuyahoga River Safety Task Force boater education video and public outreach efforts.

Congestion:

Trends/Observations:

- The delay from NS-1 Bridge being down has a domino effect because once the bridge is down, all classes of vessels begin to congregate and congestion builds. With the bridge down heavy traffic builds on both sides of the bridge, and mariners have to drift and maneuver to maintain position. Wind and waves have a negative impact on small craft operator's abilities to stay to the right side of the channel, which results in vessels dispersed across the entire width of the river. When the bridge opens, the vessels all attempt to converge to the right side of the channel, as required by the rules of the road. This convergence creates a very high risk of collision between vessels. During one recent bridge closure there were approximately 46 vessels that were underway and standing by for the bridge to open.
- There is heavy congestion around the dockage on the Flat East bank and Flats West bank. Due to the safety zones, there is limited dockage and when a dock space opens up numerous small craft will all rush to the area, which creates a risk of a collision or allision.
- Many people moor their small craft at the two marinas located at the head of navigation on the Old River. If the Old River channel is blocked by a maneuvering deep draft vessel, small craft cannot transit into or out of the Old River.
- The volume of recreational traffic in section 2 of the assessment area is much lower compared to the volume of recreational traffic that operates in section 1 of the assessment area.
- The rowing community primarily operates in section 2; they are educated in basic navigation safety, listen to the radios, and are aware of the dangers of approaching too closely to the deep draft vessels. Rowers are also accompanied by a power driven safety vessel.

Existing Mitigations:

- Law enforcement patrols within the assessment area has, until recently, been very limited due to the law enforcement authorities not wanting to risk having their vessels trapped within the assessment due to the NS-1 bridge being in the down position.
- Currently, law enforcement patrols are conducted during the daytime and evenings on most weekends. Since the stepped up law enforcement patrols were implemented, there have been relatively few issues that required law enforcement intervention.
- Cuyahoga River Safety Task Force boater education video and public outreach efforts.

Winds:

Trends/Observations:

- Average wind velocities are light to moderate, around 8 mph from April to October, and around 10 mph from October to April. Winds are predominately out of the west for the majority of the year. Destructive winds may occur during thunderstorms in the summer month.
- The Cuyahoga River experiences prevailing southwest winds in the summer, and prevailing northwest winds in the winter.
- Weather events with high winds can occur quickly and affects all vessels classes. November, December and March can produce stiff northeast winds.
- Large buildings recently constructed in downtown Cleveland have resulted in changes to wind directions which makes winds patterns less predictable than they were before the buildings were constructed.
- Deep draft vessel transporting ore are most impacted by strong winds in the longer, straighter sections of the river.
- In the Old River, the onset of strong summer winds coming from west to east affects traffic transiting the river.
- Winds of 10 knots or greater greatly affects paddle boarders, kayakers and rowers.

Existing Mitigations:

- Deep draft vessel operators have self-imposed wind restrictions.
- Cuyahoga River current and water levels are monitored by a National Oceanic and Atmospheric Administration (NOAA) observation station located at the Center Street Bridge. The information is readily available to all users of the Cuyahoga River via a live web based system to help mariners plan/prepare for changes in weather conditions.
- Commercial vessel operators have been operating within the assessment for many years and have acquired expert knowledge of the weather conditions and seasonal patterns.
- The Coast Guard issues Marine Safety Information Broadcasts (MSIB) to alert vessel operators of potentially dangerous conditions that could affect navigational safety. MSIBs can include the approach of strong winds and fast currents, visibility restrictions due to fog, heavy rain or snow, waterway locations that are congested due to permitted marine events, and the locations of reported debris and waterway obstructions.

Water Movement:

Trends/Observations:

- Water levels are primarily impacted by the water levels in Lake Erie. In 2018, the water level has remained around 50 inches above Low Water Datum. Higher than normal water levels have been the general trend over the past few years and is expected to continue into the near future.
- Currents are primarily impacted by precipitation in the river's watershed basin. The currents at the river's entrance are relatively slow (generally less than 1.5 mph) compared to velocities experienced further upstream. During periods of intense precipitation, currents can reach velocities over 3 mph.
- Currents become less stable during late summer and fall; velocity and direction can shift rapidly due to prevailing wind conditions. Currents can fluctuate quickly, reversing direction in as little as an hour.
- Severe rainstorms can produce currents approaching 4 knots.
- Currents run the strongest in the spring due to spring melt off and summer rainstorms that funnel the water from the Cuyahoga River basin into the Cuyahoga River.
- Currents above 2 knots often preclude navigating the river system by deep draft vessels transporting ore.
- Strong rains impact safe navigation by small craft due to storm water drain discharges. When small craft pass the drain discharges they are easily pushed out into the channel. Paddle boarders and kayakers are impacted the most and can be quickly pushed perpendicular from the channel edge into the center of the channel. Drain discharges are located in the heavily congested areas around Norfolk Southern Railroad Bridge #2 (NS-2), the Marathon Dock and Harpers Run. These three areas account for approximately 90% of the storm water discharge into the Cuyahoga River.

Existing Mitigations:

- NOAA observation station located at the Center Street Bridge.
- Commercial vessel operators are very familiar with the tides/currents and the impact they have on navigating large commercial vessels within a confined river system.
- Coast Guard MSIB.

Visibility Restrictions:

Trends/Observations:

- Cleveland experiences fog approximately 148 days in an average year (mostly light fog). The average visibility at Cleveland Hopkins International Airport is between 8 to 13 miles.

Existing Mitigations:

- Security calls to alert other mariners of the transit and maneuvering intentions of commercial vessel traffic.
- Communications are very good between the commercial vessels operators. Risks from visibility restrictions, changes in weather conditions, floating debris and obstructions are communicated to other vessels via VHF FM radio. Mariners share waterway and navigational conditions, which improves the safety of other vessels transiting the river systems.
- Coast Guard MSIB.

Obstructions:**Trends/Observations:**

- The majority of the Cuyahoga River watershed flows through the Cuyahoga Valley National Park. This is a heavily wooded area and is the source of common debris and refuse within the navigable channel. This debris includes small branches, logs, and sometimes entire trees.
- The ice season usually begins in early January and ends in mid-March. Ice volumes vary throughout the season depending on river currents and ambient temperatures.
- High water conditions from passing storms results in large amounts of debris flowing down the river. Debris includes large logs and trees that can make transiting the river extremely difficult for deep draft vessels, and impossible for small craft traffic. Deep draft vessels maneuvering in the river system also results in debris being kick-up and then drifting down the river with the currents.
- Spring rainstorms can create obstructions by pushing ice flows down river.

Existing Mitigations:

- The Port of Cleveland operates two debris removal vessels, Flotsam and Jetsam, to remove plastic and organic floating debris from Cleveland Harbor.
- Communications are very good between the commercial vessels operators. Risks from visibility restrictions, changes in weather conditions, floating debris and obstructions are communicated to other vessels via VHF FM radio. Mariners share waterway and navigational conditions which improves the safety of other vessels transiting the river systems
- Coast Guard MSIB.

Visibility Impediments:

Trends/Observations:

- The Cuyahoga River has multiple sharp bends that make visibility down river impossible.
- Vessels moored at various river terminals can impede visibility.
- Moving spotlights are located adjacent to the NS-1 Bridge. The spotlights are sometimes pointed down the channel and affect safe navigation.
- Abandoned bridge abutments affects the ability of mariners to see around tight bends.

Existing Mitigations:

- Security calls to alert other mariners of the transit and maneuvering intentions of commercial vessel traffic.
- Deep draft vessel operators are expert ship handlers and have extensive time operating on the river system.

Dimensions:

Trends/Observations:

- The navigable portion of the Cuyahoga River is approximately 6 miles long. The project depth for the Cuyahoga River is 28 feet from the mouth of the river to the Lorain Carnegie Viaduct and 23 feet for the remainder of the channel. The depth can vary depending on sediment buildup and dredging operations. The navigation channel in the Old River is just over 1 mile long and the project depth is 27 feet. However, the project depth cannot be maintained near the riverbank edges due to bulkhead retention concerns.
- There are 21 structures that span the river at various locations with a minimum vertical clearance of 97 feet. These structures include railroad bridges, highway bridges, power lines, and conveyor belts. Some of these structures have support foundations located in the river, reducing the width of the channel.
- Freight vessels moored at numerous river terminals can obstruct nearly half of the navigable channel.
- The NS-2 Bridge and the Maine Avenue Bridge have the shortest bridge clearances heights in the river system.
- Dredging the entire width of the channel is not possible due to most of the waterfront bulkheads being in bad condition. Dredging is offset in order to not undermine the bulkhead and result in the collapse.

Existing Mitigations:

- U.S. Army Corps of Engineers (USACE) depth surveys provide mariners with accurate water depths and channel dimensions within the assessment area.

Bottom Type:**Trends/Observations:**

- The primary bottom types of the Cuyahoga and Old Rivers are sand and mud. The banks of the rivers are lined with corrugated steel bulkheads to maintain the navigational channel depths.

Existing Mitigations:

- USACE depth surveys provide mariners with accurate water depths and channel dimensions within the assessment area.

Configuration:**Trends/Observations:**

- The majority of the river is less than 200 feet wide with multiple twists and turns, making it difficult to navigate large deep draft vessels in the confined river system.

Existing Mitigations:

- USACE depth surveys provide mariners with accurate water depths and channel dimensions within the assessment area.
- Commercial vessels operators are very experienced operating vessels on the river system.

Personnel Injuries:**Trends/Observations:**

- There are three inspected small passenger vessels operating on the Cuyahoga River; two of these vessels are over 100 feet in length.
- The largest passenger vessel operating in the assessment area can carry a maximum of 1050 persons including the crew, but typically carries a maximum of 800 persons. On busy weekends, the vessel will board approximately 5000 passengers.
- Water taxi service runs between the East Flats and the West Flats. The taxis can carry a maximum 19 people including two crewmembers. On busy weekends, the taxis can transport up to 1900 passengers in total.

Existing Mitigations:

- Good communication systems and emergency response procedures between Federal, State and local first responders.
- First responder guidance, reference maps and agency points of contract prepared by the Law Enforcement Working Group under the Area Maritime Security Commission.
- Large-scale drills and exercise are conducted and include Federal, State and Local emergency responders, waterways users, shipping company and waterfront facility representatives.
- A dedicated fireboat operates within the assessment area.
- Life rings are located at many of the waterfront facilities and can be retrieved and thrown to persons in the water.
- The Coast Guard operates a notification system to relay emergency response information to vessel company security officers and regulated waterfront facilities.
- The numerous safety zones throughout the assessment area ensure small craft do not moor in locations where deep draft vessel traffic requires room to maneuver safely.

Petroleum Discharge:

Trends/Observations:

- There are three fixed petroleum facilities on the Cuyahoga River. Two of the three only receive asphalt barges. The other facility does not currently transfer any bulk liquid cargo by vessel. In addition, there are six mobile transfer operations providing fuel and other products to commercial vessels.

Existing Mitigations:

- A dedicated fireboat operates within the assessment area.
- Large-scale drills and exercise are conducted and include Federal, State and Local emergency responders, waterways users, shipping company and waterfront facility representatives.
- The Coast Guard operates a notification system to relay emergency response information to vessel company security officers and regulated waterfront facilities.
- First responder guidance, reference maps and agency points of contract prepared by the Law Enforcement Working Group under the Area Maritime Security Commission.

Hazardous Materials Release:

Trends/Observations:

- Although there are no hazardous materials transported by vessel within the assessment area, it was noted that hazardous materials are routinely shipped via highway and railroad routes that cross the assessment area in numerous locations. The assessment area could be impacted by a hazardous materials release from either a railcar derailment or highway accident.

Mobility:

Trends/Observations:

- The Cuyahoga River is a vital waterway used to transport raw materials to multiple facilities along the riverbanks. It is also the primary means for transporting ore to the ArcelorMittal steel mill.
- A long-term failure of one of the multiple drawbridges that span Cleveland's River system would close the waterway to large commercial vessels and could severely affect North East Ohio economy.
- If the NS-1 experiences a breakdown in the down position for an extended period of time it would immediately affect commerce and shut down ArcelorMittal steel mill, the limestone trade, and the iron ore trade, and outbound salt shipments.

Existing Mitigations:

- Large scale drills and exercise are conducted that include Federal, State and Local emergency responders, waterways users, shipping companies and waterfront facility representatives.
- Strong communication lines between Federal/State agencies and waterways users and stakeholders.
- The Coast Guard operates a notification system to relay emergency response information to vessel company security officers and regulated waterfront facilities.

Health and Safety:

Trends/Observations:

- Because there are no hazardous materials transported through the assessment area, health and safety impacts to the greater Cleveland area because of a port closure would be economic in nature.

Environmental:

Trends/Observations:

- Because there are no hazardous materials transported by vessel through the assessment area, the risk of an environmental impact would be minimal. As noted in the Hazardous Materials discussions, the assessment area could be impacted by a hazardous materials release from either a railcar derailment or highway accident.

Aquatic Resources:

Trends/Observations:

- NOAA's Environmental Sensitivity Index states there are no environmentally sensitive areas within the assessment area.

Economic:

Trends/Observations:

- The estimated annual business revenue generated from all industries within the assessment area is approximately \$10 billion annually.
- A long-term port closure would have immediate impacts to the local economy and gradual impacts to the regional economy due to halted shipments of steel, limestone and salt that regional industries rely upon.
- Several marinas, yacht clubs and facilities that service boats that would be impacted by a port closure.

Existing Mitigations:

- Large scale drills and exercise are conducted that include Federal, State and Local emergency responders, waterways users, shipping companies and waterfront facility representatives.
- Strong communication lines between Federal/State agencies and waterways users and stakeholders
- First responder guidance, reference maps and agency points of contract prepared by the Law Enforcement Working Group under the Area Maritime Security Commission.

Appendix C

Workshop participants identified, discussed and evaluated additional risk intervention strategies to further reduce risks. The recommended additional risk intervention strategies should not be construed to represent the views of or statements by the United States Coast Guard.

Additional Risk Intervention Strategies

Small Craft Quality:

- Install signage along the East and West Flats waterfront, small craft rental facilities and in the adjacent restaurants and businesses to communicate the estimated time of arrival of approaching commercial traffic.
- Install multiple LED displays along the East and West Flats areas that display the status of commercial vessel movements.
- Install an LED display (countdown clock) on both sides of the Norfolk Southern Bridge #1 that communicates the estimated wait time until the bridge lifts.
- Clarify existing safety zone signage to alert small craft operators that the safety zones are actually hazardous areas, and should be avoided when deep draft vessels are maneuvering.
- Reduce VHF FM radio traffic by designating a channel, other than VHF FM channel 13, for commercial traffic to utilize.
- Remove the mooring cleats along the safety zone located on the East Flats.
- Implement a mandatory small craft licensing and certification program that outlines the dangers of operating small craft on the Cuyahoga River. Require classroom attendance and an on water practical demonstration as part of the certification process.
- Increase funding and resources to improve existing boating safety outreach programs.
- Require businesses that rent small craft, including paddleboards and kayaks, to provide basic boating safety training, specific to the Cuyahoga River, before persons can rent and operate these types of craft. Increase law enforcement patrols to verify compliance.
- Increase funding and resources for law enforcement patrols.
- Improve vessel accident reporting and data collection.
- Increase and improve funding and resources for boating safety outreach programs, advertise programs on social media and in public/private school systems via print and electronic methods.
- Develop Cuyahoga River specific small craft Standard Operating Procedures for rental craft operators and rental facility managers.
- Designate restricted areas where paddle craft cannot operate.
- Establish a Coast Guard operated Vessel Traffic Service that monitors and controls vessel traffic, and relays traffic conditions and safety alerts to waterways users.

Traffic Mix:

- Designate restricted areas where paddle craft cannot operate.
- Implement a mandatory small craft licensing and certification program that outlines the dangers of operating small craft on the Cuyahoga River. Require classroom attendance and an on water practical demonstration as part of the certification process.
- Increase funding and resources to improve existing boating safety outreach programs.
- Develop a certification program for paddle craft operators, document compliance with the program by use of paddle craft stickers carried by the paddle craft operators.
- Increase funding and resources for law enforcement patrols.
- Require paddle craft and kayak operators to take the Ohio State Boating Safety Exam that is currently required for operators of motor boats over 10 hp.
- Increase and improve funding and resources for boarding safety outreach programs, advertise programs on social media and in public/private school systems via print and electronic methods.
- Develop Cuyahoga River boating safety information placemats for use by restaurants.
- Designate paddle craft launch and recovery areas.
- Develop boating safety placards and affix to kayaks and paddleboards for quick reference by the operators.
- Develop a Cuyahoga River boating safety website that includes boating safety resources, Automatic Identification System information, boating safety references, videos, river maps, rules and regulations and industry best practices.
- Establish a dedicated Public Service small craft to engage paddle craft operators while underway and educate them on boating safety best practices.
- Establish a Coast Guard operated Vessel Traffic Service that monitors and controls vessel traffic, and relays traffic conditions and safety alerts to waterways users.

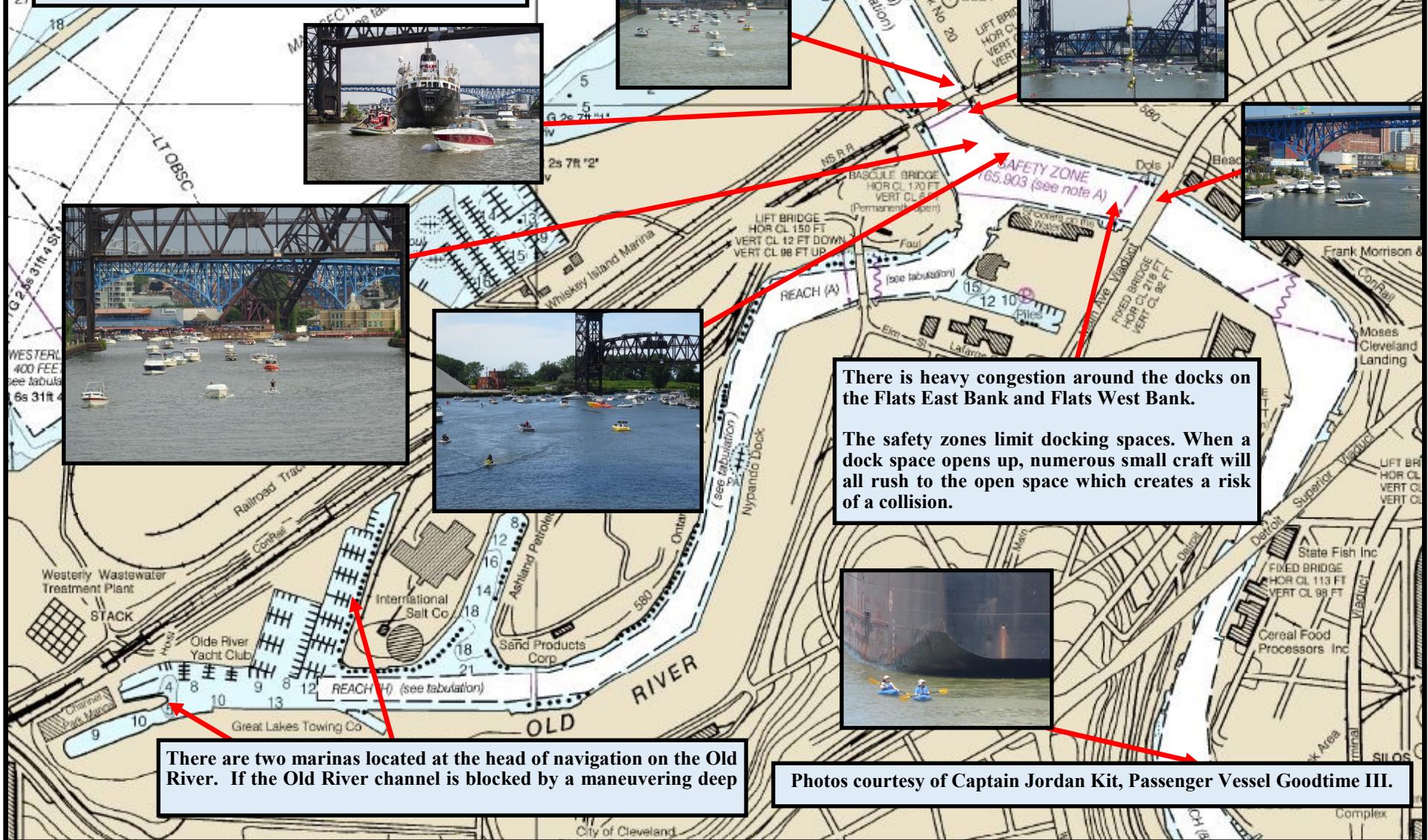
Congestion:

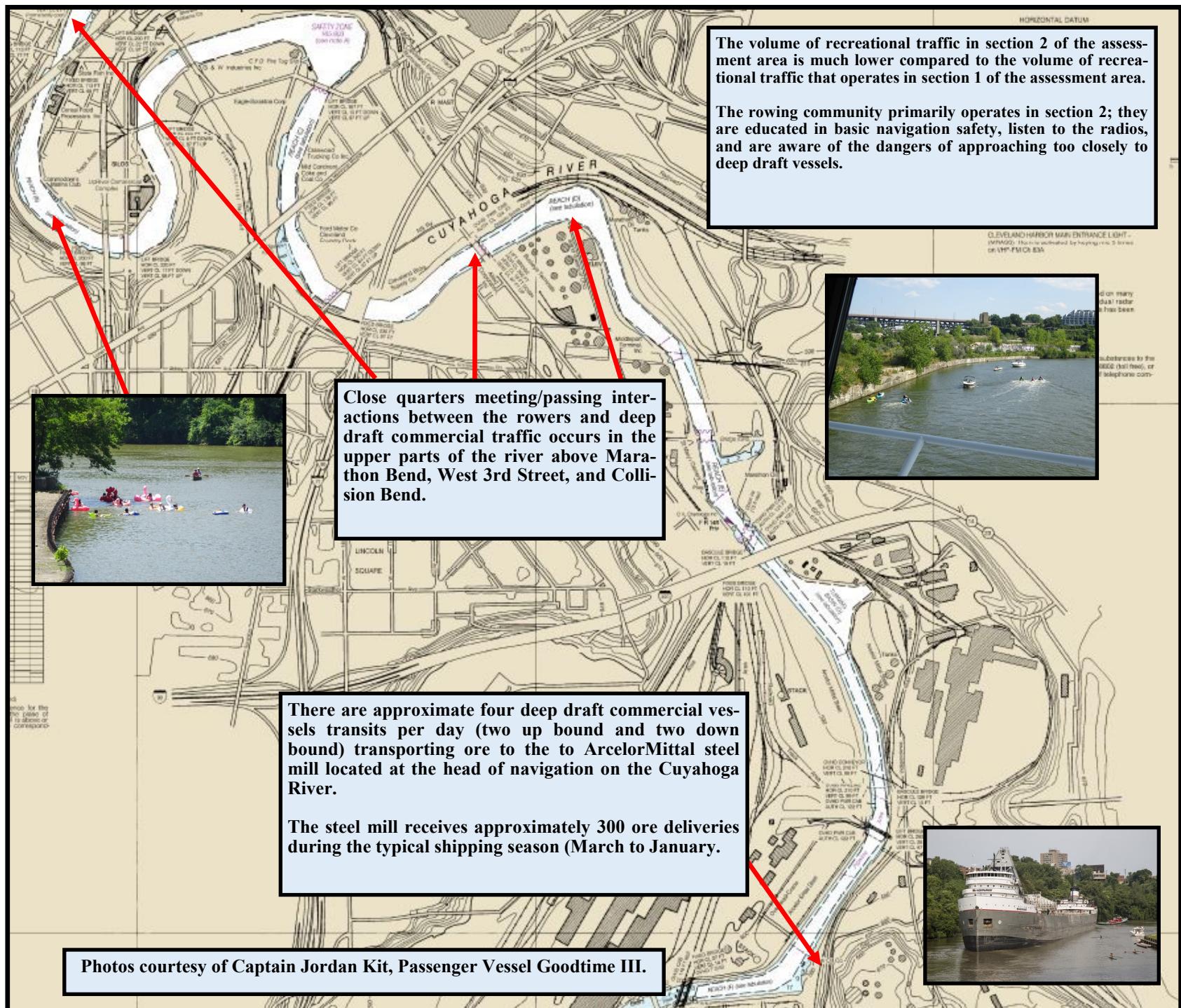
- Install a LED display (countdown clock) on both sides of the Norfolk Southern Bridge #1 that communicates the estimated wait time until the bridge lifts. Require Norfolk Southern bridge tenders to monitor vessel traffic and keep the countdown clock updated with lift wait times.
- Improve the timeliness and communication of the Norfolk Southern Bridge #1 opening schedule.
- Conduct partial lifts of the Norfolk Southern Bridge #1.
- Establish a time limit for Norfolk Southern Railroad bridge tenders to respond back to mariners inquires on whether they (Norfolk Southern) will lift the bridge or not.
- Explore rerouting the trains from the Norfolk Southern Bridge #1, to the Norfolk Southern Bridge #2, to reduce the number lifts that Bridge #1 makes.
- Install multiple LED displays along the East and West Flats areas that displays the status of commercial vessels traffic movements.
- Develop a Cuyahoga River boating safety website that includes boating safety resources, Automatic Identification System information, boating safety references, videos, river maps, rules and regulations and industry best practices.
- Develop waterway signage for the entire river system; model it after the highway signage system.
- Ensure small craft do not moor in safety zones when commercial traffic is transiting the zones.
- Implement law enforcement escorts of commercial vessels to clear small craft out of the channel.
- Designate restricted areas where paddle craft cannot operate.
- Increase funding and resources for law enforcement patrols.
- Move security calls for rowers to VHF FM working channel 12 to reduce radio clutter and place sign directing channel 12 usage on the Norfolk Southern Bridges.
- Improve vessel accident reporting and data collection.
- Establish a Coast Guard operated Vessel Traffic Service that monitors and controls vessel traffic, and relays traffic conditions and safety alerts to waterways users.
- Establish a Cuyahoga River Harbormaster to oversee safety on the riverfront, and educate, manage and train dock masters to assist recreational boaters.

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The entrance to the Cuyahoga River, and the East and West Flats areas, are heavily congested areas during the weekends and holidays. Large numbers of small craft operate in very close quarters with the deep draft commercial vessels.

Close quarters interactions between large commercial vessels and recreational vessels, due to the limited width of the Cuyahoga River, are a normal occurrence.





Appendix E

References

Ohio State Boating Laws

<http://watercraft.ohiodnr.gov/>

Ohio Environmental Protection Agency

<https://epa.ohio.gov/>

Ohio Boat Operators Guide

<http://watercraft.ohiodnr.gov/portals/watercraft/pdfs/laws/OperatorsGuide.pdf>

Cleveland Metro Parks

<https://www.clevelandmetroparks.com/>

Cuyahoga River Safety Task Force – Sharing the Waterway Video

<https://www.dvidshub.net/video/522761/sharing-waterways>

Rock the Lakes - Live web cam – Cleveland

<http://www.rockthelake.com/music-box-supper-club-bridge-cam/>

U.S. Coast Guard - Vessel Inspection Regulations

<http://www.ecfr.gov/cgi-bin/ECFR?page=browse>

U.S .Coast Guard - Vessel Traffic Services

<https://www.navcen.uscg.gov/?pageName=vtsLocations>

U.S. Coast Guard Auxiliary - Requirements for Recreational Boats

<http://www.cgaux.org/boatinged/classes/2011/bss.php>

U.S. Navigation Rules

<http://www.navcen.uscg.gov/?pageName=navRuleChanges>

U.S. Army Corps of Engineers - Regulatory Policies

<http://www.usace.army.mil/Missions/>

U.S. Army Corps of Engineers - Vessel Transit Statics

<http://www.navigationdatacenter.us/>

National Oceanic and Atmospheric Administration, National Ocean Service

<https://oceanservice.noaa.gov/>

State-Specific Boating Safety Requirements

<http://www.americasboatingcourse.com/lawsbystate.cfm>

United States Power Squadrons

<https://www.usps.org/>

National Safe Boating Council

<https://www.safeboatingcouncil.org/>

The American Waterways Operators
<http://www.americanwaterways.com/>

Life Lines Brochure - Safety Tips That Could Save Your Life
http://www.americanwaterways.com/commitment_safety/lifelines.pdf

Recreational Boating Safety - Accident Statistics
http://www.uscgboating.org/statistics/accident_statistics.php

American Canoe Association
<http://www.americancanoe.org/>

Appendix F

Abbreviations and Acronyms

ACP – Area Contingency Plan
AIS – Automated Identification System
ANPRM – Advance Notice to Proposed Rule Making
ATON – Aids to Navigation
BWI – Boating While Intoxicated
COTP – Captain of the Port
EPA – Environmental Protection Agency
MARAD – Maritime Administration
MSIB – Marine Safety Information Broadcast
MTS – Marine Transportation System
MTSRU – Marine Transportation System Recovery Unit
NDG – National Dialogue Group
NEPA – National Environmental Policy Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic Atmospheric Administration
OSRO – Oil Spill Response Organization
ODNR – Ohio Department of Natural Resources
PAWSA – Ports and Waterways Safety Assessment
PDF – Personal Flotation Device
PSC – Port State Control
PORTS - Physical Oceanographic Real-Time System
RNA – Regulated Navigation Areas
STCW – Standards of Training Certification of Watchkeeping
USACE – United States Army Corps of Engineers
USCG - United States Coast Guard
VHF – Very High Frequency
VMRS – Vessel Movement Reporting System
VTM – Vessel Traffic Management
VTS – Vessel Traffic Service